

DRAFT

From: Ed Cabc To: Examiner Cam Nguyen

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To : Examiner Cam Nguyen

From : Ed Cabc

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Subject : Proposed Draft for Interview May 1 at 2 pm

Please call me if you have any questions.

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RESPONSE AFTER FINAL REJECTION
EXPEDITED PROCEDURE
GROUP 1700

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Naomi NODA et al.

Serial No.: 09/735,930

Group Art Unit: 1754

Filed: December 14, 2000

Examiner: Cam N. Nguyen

For: CATALYST BODY

DRAFT - NOT OFFICIAL FOR FILE

REQUEST FOR RECONSIDERATION

Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicants request reconsideration of the rejection in the Final Rejection mailed January 27, 2003, in view of the following remarks.

Claims 1 to 8 remain herein.

1. Claims 1-8 were rejected under 35 U.S.C. 103(a) as unpatentable over Lindner et al., hereinafter "Lindner", (U.S. Pat. 6,348,430 B1) taken together with Deeba et al., hereinafter "Deeba", (U.S. Pat. 6,375,910 B1). The rejection is traversed.

The present invention is directed to solving the problem caused by the adverse effect alkali metals have on a catalyst

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carrier in catalyst compositions when the catalyst operates at high temperatures. This problem is discussed on page 2, lines 2-10, of the specification thusly:

The carrier, however, is easily corroded and deteriorated by alkali metals or some alkaline earth metals being activated under high temperature conditions derived from automobile exhaust gas, especially, Li, Na, K and Ca. In particular, there is a serious problem that a cordierite carrier made of an oxide type ceramic material generates cracks, since the carrier easily reacts with the above-mentioned alkali and alkaline earth metals, etc.

Applicants solved this prior art problem by inventing a catalyst having a long duration period. The inventive catalyst is formed by adding an "anchor" material (called in the claims "a substance capable of reacting with the alkali metal, dominating over the reaction between the main components of the carrier and the alkali metal") that will react more with these alkali metals than will the catalyst carrier. See also specification Paragraphs [0005] and [0006]. Preferred "anchor" materials are recited in claim 2. There is no teaching in the cited art of adding such an

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"anchor" material to a catalyst composition for any reason, let alone to solve this durability problem.

Applicants conducted tests to compare the catalyst of the present invention with four similar catalysts that did not contain the "anchor" materials. The catalyst compositions and test data are in Tables 1 and 2. A summary of the results of the data appears following those tables and reads:

[0073] As shown in Table 1 and Table 2, each of the NOx adsorption catalysts 1 to 32 based on the present invention, as compared with the comparative NOx adsorption catalysts 33 to 36 containing no anchor substance, was little in crack generation in carrier and low in strength decrease.

Thus in Table 2 in the second page for the four Comparative Examples 33-36 without any anchor substance, the generation of cracks was "very much" for 3 of the Comparative Examples and for the other the crack generation was "much." The decrease in strength for the four Comparative Examples was 75%, 79%, 80% and 58%; those values should be compared to much lower values according to the Examples of the present invention.

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There is no teaching or suggestion in the art of such improved results by using an anchor material for an alkali metal containing catalyst according to the present invention.

Lindner merely proposes the use of the oxygen-storing components to cope with the periodic variations in the normalized air/fuel ratio by releasing or binding oxygen. Lindner teaches this concept at col. 1, line 28 to 41, and the preference of cerium oxide for such purpose at lines 35-41:

To produce better conversion of oxidizable hazardous components under these conditions, oxygen-storing components such as, for example, pure cerium oxide or cerium oxide-containing components are used which bind oxygen when it is present in excess and release it again when there is a deficiency of oxygen in the exhaust gas.

Indeed, Lindner is completely silent about the use of NOx adsorption component in the exhaust gas catalyst.

Lindner discloses an exhaust gas catalyst containing two catalytically active layers on a carrier structure as depicted in the diagram below:

2 nd layer

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<ol style="list-style-type: none">1. several finely divided solids wherein at least one is a finely divided oxygen-storage material, and2. at least one platinum group metal; <p>only a portion of these finely divided solids in the second layer is used as support for the platinum group metals in the second layer.</p>
<p><u>1st layer</u></p> <ol style="list-style-type: none">1. several finely divided solids wherein at least one is a finely divided oxygen-storage material,2. one or more highly dispersed alkaline earth metal oxides and3. at least one platinum group metal. The platinum group metals are in close contact with all of the constituents in the first layer.
Carrier Structure

The first layer applied to the carrier structure is described in col. 4, lines 26-34. See the diagram above for its content. The second layer is described in col. 4, lines 48-60, and its content also is given in the diagram above.

The finely divided solids in each of these layers comprise at least one finely-divided oxygen-storing material and at least one other finely divided component.

The "finely divided components" are described in col. 4, line 61 to col. 5, line 10. The "finely divided components" may be oxides of alkaline earth metal, oxides of scandium, yttrium, gallium, indium, silicon, titanium, zirconium, hafnium, germanium,

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tin, lead, vanadium, niobium, tantalum, chromium, molybdenum, and tungsten.

The Lindner catalyst is not a NO_x adsorption catalyst. See the description of the purpose of the catalyst in col. 4, lines 10-22:

To reduce cold-start emissions, start catalysts and main catalysts are installed near the engine, these being heated to their light-off temperatures very rapidly by the hot exhaust gases, but also being subjected to peak temperatures of up to 1050 °C. at the entrance to the catalyst during the normal driving phase. An object of the present invention is, therefore, to provide a catalyst which has a higher activity and heat resistance than known catalysts. A further object of the invention is to achieve a higher activity and heat resistant catalyst with the smallest possible amount of noble metals, that is in the most cost-effective manner possible.

There is no mention of trying to form an improved NO_x adsorption catalyst.

The present claims were amended in the Amendment filed November 1, 2002, to specify that the catalyst layer contains an alkali metal by deleting "and/or alkaline earth metal." See page 2 of the specification at line 6 where Li, Na and K are especially noted as causing corrosion and deterioration. There is no mention of having an alkali metal present in the Lindner catalyst as acknowledged by the Examiner in the Office Action in the first line of the first full paragraph on page 3.

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Deeba relates to a multi-zoned catalytic trap for conversion of NO_x in an exhaust gas stream leaving an engine that is operated with periodic alternations between lean, and stoichiometric or rich, conditions. See col. 5, lines 3-6, for the first embodiment:

The first embodiment of the invention pertains to a multi-zoned catalytic trap having a first zone, a second zone and optionally, one or more zones intermediate the first and second zones.

See col. 8, lines 58-63, for the second embodiment:

As a second embodiment of the invention, the first catalytic trap material, second catalytic trap material and optional intermediate catalytic trap materials in the first, second and optional intermediate zones, respectively, are present as a discrete bottom layer and a discrete top layer overlying the bottom layer.

See col. 10, lines 31-60, for the third embodiment that is summarized at lines 31-36:

As a third embodiment, the catalytic trap of the invention may be prepared in the form of layers, but without any zones within either the bottom or the top layer. In this third embodiment, the catalytic trap will nevertheless be "multi-zoned" because of post-impregnated layers superimposed on "zones," i.e., "sections," of the top layer.

The Examiner contends that Deeba teaches a similar exhaust gas catalyst utilizing one or more alkali metals as a NO_x sorbent and cites Deeba at col. 23, lines 28-31. That cited passage is in

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claim 1 where the first catalytic trap material in part (B) is said to comprise:

(B) a NO_x sorbent comprising one or more basic oxygenated compounds of one or more alkaline earth metals and optionally, one or more basic oxygenated compounds of one or more alkali metals.

(Emphasis added)

This broad NO_x sorbent language appears to be used throughout Deeba. The use of alkali metals is said to be optional.

71 In the Deeba examples (Example 1 Traps A-F and Example 5 Trap G), the NO_x sorbent has the following approximate composition:

0.115 g/in³ BaO;
0.50 g/in³ CeO₂-ZrO₂;
0.08 g/in³ ZrO₂

with only compounds of alkaline earth metal barium (Ba) being used.

However, the description of the production of Trap A in col. 18, lines 41-43, states:

After the one-zoned catalytic trap was prepared, it was post-dipped with Cs to provide a Cs₂O post-dipped coat of 0.35 g/in³.

This applied alkali metal cesium (Cs) is the least reactive of the alkali metals.

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The post-dipping procedure is described in col. 21, lines 24-31:

7. Post-dipping

The calcined catalyst was then post-dipped in a solution of cesium nitrate and/or barium nitrate, NO_x sorbent precursor compounds, in an amount to provide in the finished catalytic trap the weights of cesium oxide and/or barium oxide indicated in Example 1. The post-dipped trap members were then dried at 110° C. for 4 hours and calcined at 550° C. for 1 hour.

There is no mention of using any of the active alkali metal as discussed on the top of page 2, lines 2-10, of the present specification where these alkali metals are listed as Li, Na, and K and where the active alkaline earth Ca is also listed.

The Office Action provides no motivation as to how any ordinary artisan would try to combine the teachings of Lindner with those of Deebea to solve the problem of the deterioration of the substrate by the alkali metal used as NO_x adsorption component.

Both of the references are quite silent as to the deterioration problem of a substrate such as cordierite causing by

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the alkali metals. For example, Deeba in col. 2, lines 56-62, copied below states:

Although lean-burn engines provide enhanced fuel economy, they have the disadvantage that conventional TWC catalysts are not effective for reducing NO_x emissions from such engines because of excessive oxygen in the exhaust.

There is no mention of any substrate deterioration problem; merely that TWC catalysts are not effective in reducing NO_x. Lindner, on the other hand, merely suggests the alternate use of the metal substrate and ceramic substrate. See col. 1, lines 42-51:

The present invention deals with catalyst coatings on inert, monolithic carrier structures, in particular honeycomb structures with parallel flow channels for the exhaust gas. The number of flow channels per cross-sectional area is called the cell density. Inert carrier structures with cell densities between 10 and 250 cm² are used, depending on the requirements of the application. These may be extruded, ceramic carrier structures made from cordierite, mullite or similar, temperature resistant materials. Alternatively, honeycomb structures made from steel sheeting may be used.

Since these two references relate to different types of automotive catalysts, they provide no suggestion to combine their features. As discussed above, the objects for the Lindner catalyst establish it is merely an ordinary automotive catalyst with noble metals to provide for high temperature resistance. Deeba, on the other hand, is directed to a NO_x conversion catalyst with primarily

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an alkaline earth (Ba) component. There is no suggestion to the person of ordinary skill in the catalyst art to take a Deeba NO_x catalyst component and randomly add it to a conventional noble-metal containing auto exhaust catalyst. There clearly is no teaching in these two references of the unexpected and superior results obtained by applicants and compiled in Tables 1 and 2 of the specification.

Applicants believe one of the first recognitions of the substrate deterioration problem of the ceramic substrate is found in JP-A-10-165817 which has a relatively recent publication date of June 23, 1998. A copy is submitted herewith and it includes an English language abstract. The abstract points out that improved durability against high temperature for a NO_x inclusion material containing an alkali metal can be achieved by using a support that has no silicon (Si) with alpha-alumina and zirconia being preferred. Lindner and Deeba do not relate to recognizing and solving this problem that is recognized by JP-A-10-165817.

Accordingly, reconsideration and withdrawal of the rejection is earnestly solicited.

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Applicants respectfully submit that the present application is now in condition for allowance. Accordingly, the Examiner is requested to issue a Notice of Allowance for all pending claims.

Should the Examiner deem that any further action by the applicants would be desirable for placing this application in even better condition for issue, the Examiner is requested to telephone applicants' undersigned representative at the number listed below.

Respectfully submitted,

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Date

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